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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/785,944	02/16/2001	Martin E. Fermann	IMRAA.015C1	7227

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EXAMINER

FLORES RUIZ, DELMA R

ART UNIT

PAPER NUMBER

2828

DATE MAILED: 04/24/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

9/785,944

Applicant(s)

FERMANN, MARTIN E.

Examiner

Delma R. Flores Ruiz

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 17 January 2002.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-50, and 55-58 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1 - 19, ~~22-42~~ <sup>22-47</sup> 46-47, 50 and 55 - 58 is/are rejected.
- 7) ☒ Claim(s) 20, 21 and ~~43-45~~ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

  
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**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.  
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

**Priority under 35 U.S.C. §§ 119 and 120**

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☐ All b) ☐ Some \* c) ☐ None of:  
1. ☐ Certified copies of the priority documents have been received.  
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).  
\* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).  
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 6
- 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

## DETAILED ACTION

The prior Office action (Double Patenting) is hereby vacated in favor of the following.

### *Drawings*

The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they do not include the following reference sign(s) mentioned in the description:

integrated cavity (59) on page 11, line 21,  
laser cavity (75) on page 11, lines 30 – 31, and page 12, line 17,  
cavity (87) on page 13 line 17 – 18,  
particularly simple cavity design (99) on page 14, line 3, and  
mode-locked laser (105) on page 14, line 14.

Correction is required.

Any structural detail that is essential for a proper understanding of the disclosed invention should be shown in the drawing. MPEP § 608.02(d). Correction is required.

Applicant is required to submit a proposed drawing correction in reply to this Office action. However, formal correction of the noted defect can be deferred until the application is allowed by the examiner.

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1 – 19, 22 – 42, 46 – 47, 50, and 55 - 58 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fermann et al (5,627,848) in view of Stock et al (6,249,630 B1).

Regarding claims 1 – 19, 22 – 42, 46 – 47, 50, and 55- 58 , Fermann et al disclose a laser for generating ultra-short optical pulses (Fig. 1, 4 – 8), comprising: a cavity which repeatedly passes light energy along a cavity axis; a length of multi-mode optical fiber (101) doped with a gain medium and positioned along said cavity axis; a pump (103) for exciting said gain medium. A laser for generating ultra-short optical pulses wherein said mode-locking mechanism comprises a passive mode-locking element (Fig. 1, and Column 3, lines 13 – 26). A laser for generating ultra-short optical pulses wherein said passive mode locking element comprises a saturable absorber (abstract, Column 3, lines 13 – 26, Column 5, lines 61 – 63). A laser for generating ultra-short optical pulses wherein said saturable absorber comprises InGaAsP (Column 5, lines 61 – 63). A power limiter for protecting said saturable

absorber (Figs. 1, 4, 6 and 8, character 118). A laser for generating ultra-short optical pulses wherein said optical guide comprises a single-mode mode-filter (201) fiber on said cavity axis (Column 7, lines 28 – 43 and Column 8, lines 11 – 22). A laser for generating ultra-short optical pulses, additionally comprising a polarization beam splitter (117, abstract, Column 5, lines 10 – 23) for outputting said ultra-short optical pulses from said laser. A laser for generating ultra-short optical pulses, wherein said cavity comprises a pair of reflectors (102, 106) at its opposite ends. A laser for generating ultra-short optical pulses, wherein one of said pair of reflectors (302, 102, 106, Column 7, lines 55 – 67 and Column 8, lines 1 – 22) is partially reflecting and provides the output for said cavity. A laser for generating ultra-short optical pulses, wherein said mode locking mechanism comprises a saturable absorber, and wherein one of said reflectors is formed on a surface of said saturable absorber (Column 7, lines 55 – 67 and Column 8, lines 1 – 59). A laser for generating ultra-short optical pulses, additionally comprising a linear phase drift compensator on said cavity axis (Fig. 1, 4 – 8 and Column 5, lines 10 – 23). A laser for generating ultra-short optical pulses wherein said linear phase drift compensator comprises a Faraday rotator (113 or 114, Fig. 8, and Column 1, lines 49 – 56 and Column 5, lines 10 – 23). A laser for generating ultra-short optical pulses, wherein said linear phase drift compensator comprises a pair of Faraday rotators (113, 114, Fig. 8, and Column 1, lines 49 – 56 and Column 5, lines 10 – 23). 25. A laser for generating ultra-short optical pulses additionally comprising a linear polarization transformer on said cavity axis (117, abstract, Column 5, lines 10 –

23 and Column 7, lines 55 – 67). A laser for generating ultra-short optical pulses, wherein said linear polarization transformer comprises a wave plate (Fig. 8 Column 5, lines 10 – 23 and Column 6, lines 7 – 16). A laser for generating ultra-short optical pulses, wherein said mode locking mechanism comprises an active mode-locking element (Fig. 6). A laser for generating ultra-short optical pulses, wherein said active mode locking element comprises an optical amplitude modulator (301 or 302 in Fig. 6, Column 7, lines 44 – 54 and Column 8, lines 6 – 22). A laser for generating ultra-short optical pulses, wherein said active mode locking element comprises an optical frequency modulator (301 or 302 in Fig. 6 and Column 7, lines 44 – 54). A laser for generating ultra-short optical pulses, wherein said ultra-short optical pulses preferentially in the fundamental mode of said multi-mode optical fiber have a pulse width below 500 psec (Column 2, lines 51 – 67). A laser for generating ultra-short optical pulses, additionally comprising an environmental stabilizer on said cavity axis to assure that said cavity remains environmentally stable (Column 7, lines 55 – 67 and Column 8, lines 1 – 22). 32. A laser for generating ultra-short optical pulses, wherein said environmental stabilizer comprises a Faraday rotator (113 or 114, Fig. 8, and Column 1, lines 49 – 56 and Column 5, lines 10 – 23). A laser for generating ultra-short optical pulses, wherein said environmental stabilizer comprises a pair of Faraday rotators (113 or 114, Fig. 8, and Column 1, lines 49 – 56 and Column 5, lines 10 – 23).

A laser for generating ultra-short optical pulses, wherein said optical guide comprises an optical fiber doped with an amplifying medium to provide gain guiding (Column 8, lines 1 – 59). A laser for generating ultra-short optical pulses, wherein said amplifying medium is concentrated centrally within a fraction of the core diameter of said optical fiber (Column 4, lines 19 – 40). A laser for generating ultra-short optical pulses, wherein said optical guide comprises a single-mode optical fiber on said cavity axis ( Fig. 5, 201 and Column 7, lines 20 – 43). 40. A laser for generating ultra-short optical pulses, wherein said cavity additionally comprises a positive dispersion element (Fig. 5, and Column 7, lines 20 – 43). A laser for generating ultra-short optical pulses, wherein said positive dispersion element comprises a length of single-mode positive dispersion fiber positioned along said cavity axis (Fig. 5, and Column 7, lines 20 – 43). A laser for generating ultra-short optical pulses, additionally comprising an output coupler for limiting the light energy at said single-mode positive dispersion fiber to less than 10% of the peak power in said cavity (Fig. 5, and Column 7, lines 20 – 43). A laser for generating ultra-short optical pulses, wherein said mufti-mode fiber includes a core, and wherein said gain medium in said mufti-mode optical fiber is concentrated centrally within the core of said mufti-mode fiber (Fig. 1 and , 4 – 8, and Column 9, lines 19-24). A laser for generating ultra-short optical pulses, wherein said mufti-mode optical fiber is polarization-maintaining (Column 5, lines 10 23, and Column 8, lines 32 – 49). A laser for generating ultra-short optical pulses, wherein said cavity additionally comprises a fiber grating (105) written onto said mufti-mode fiber, said grating (105) primarily

reflecting the fundamental mode of said mufti-mode fiber. A mode-locked laser for generating high power ultra-short optical pulses (Fig. 1, 4 – 8), comprising: a mufti-mode optical fiber (101) doped with gain material for amplifying optical energy; means for pumping (103) said optical fiber; and means for confining the optical energy amplified by said mufti-mode optical fiber to substantially the fundamental mode of said mufti-mode optical fiber .

Fermann discloses the claimed invention except for the multi-mode optical fiber doped with a gain medium and positioned along said cavity axis, , the single mode filter is fusion spliced onto one end of said multi-mode optical fiber, the multi-mode fiber and multi mode filter fiber are tapered at said fusion spliced, and the pump is coupled to said multi-mode fiber along said cavity axis. It would have been obvious at the time of applicant's invention, to combine Stock et al of teaching a multi-mode optical fiber doped with a gain medium and positioned along said cavity axis with a laser for generating ultra-short optical pulse because the stretched optical pulses are then transmitted through a fiber which delivers the optical pulses to a desired location.

Single-mode fiber is preferred for many applications, since multi-mode fiber can present the complexity of the different modes presenting differing propagation lengths. However, multi-mode fiber can be used to advantage in a number of situations. Multi-mode fiber has a larger effective mode-field diameter, and accordingly a higher peak power delivery capability. One particularly attractive case for using multimode fiber in delivery (using either passive or active (amplifier) fiber) is the case when the lowest order mode



is excited in a multimode fiber. This takes advantage of the larger effective mode-field diameter, allowing for higher peak power delivery due to lower non-linear effect threshold, while avoiding the dispersion problem from the transmission of several modes through the fiber. And it would have been obvious at the time of applicant's invention, of teaching a laser for generating ultra-short optical pulses wherein said single-mode mode-filter fiber is fusion spliced onto one end of said multi-mode optical fiber, a multi-mode fiber is tapered at said fusion splice, the pump is coupled to said multi-mode fiber along said cavity axis, and v-groove on the multi-mode optical fiber for coupling said pump to said multi-mode fiber because are very well known in the art and hence would have been obvious to one of ordinary skill in the art at the time the invention was made to apply these teachings to the claimed apparatus.

One of ordinary skill in the art would have recognized that the method as claimed is implicitly stated over the description of the apparatus disclosed above.

### ***Allowable Subject Matter***

Claims 20, 21, 43, 44, and 45 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. Claims 20 – 21, and 43 – 45 have been allowed over the prior art because they fail to teach a laser for generating ultra-short optical pulses wherein said mode locking mechanism comprises a

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saturable absorber is formed on a surface of said power limiter opposite said one of said reflectors. ~~A laser for generating ultra-short optical pulses, wherein said frequency converter comprises a frequency doubler. A laser for generating ultra-short optical pulses, wherein said frequency doubler comprises chirped periodically poled LiNbO<sub>3</sub>.~~

### **Conclusion**

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Delma R. Flores Ruiz whose telephone number is (703) 308-6238. The examiner can normally be reached on M - F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Paul Ip can be reached on (703) 308-3098. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-7722 for regular communications and (703) 308-7724 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 306-3431.

  
Delma R. Flores Ruiz  
Examiner  
Art Unit 2828

Paul Ip  
Supervisor Patent Examiner  
Art Unit 2828

DRFR/PI  
April 18, 2002